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Evaluation of F_6 Intergeneric Population of Papaya (*Carica papaya* L) for Resistance to Papaya Ring Spot Virus (PRSV)

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There have been numerous attempts to transfer *Papaya ringspot virus type P* (PRSV-P) resistance from wild *Vasconcellea* relatives to *Carica papaya* L. Success has been limited by the high degree of genetic divergence and incompatibility. In the present work, the advanced intergeneric population of *Carica papaya* (var. Arka Surya) and *Vasconcellea cauliflora* were evaluated for morphological, fruit traits and PRSV- P tolerance. Among the 38 F_6 intergeneric progenies evaluated, seven progenies were found to be tolerant under field condition. The fruit quality traits were also found to be acceptable coupled with disease tolerance. These selected progenies recorded fruit traits *viz.*, fruit weight (624-820 g), pulp thickness (2.44-3.18 g), TSS (9.05- 10.04 ° B), acidity (0.11- 0.15 %) and total carotenoids (3.63- 9.08 mg $100g^{-1}$FW). Thus, based on the morphological traits, fruit quality and PRSV tolerance, the advanced intergeneric progenies *viz.*, R_5P_{16}, R_6P_{16}, R_7P_{16}, $R_{14}P_7$, $R_{17}P_{16}$, $R_{19}P_1$ and $R_{35}P_{10}$ may be forwarded for next generation (F_7) and further evaluation.

Introduction

Papaya (*Carica papaya* L.) is one of the most important fruits of tropical and subtropical regions of the world belong to family Caricaceae. It is a dicotyledonous, polygamous and diploid species with geographical origin being Southern Mexico and Costa Rica (Candolle, 1884). The fruit has high nutritive and medicinal value (Azad, *et al.*, 2012) especially vitamin A (2020 IU/100g). It also possesses vitamin B, folate and pantothenic acid besides minerals like potassium and magnesium (Popenoe, 1974 and Samson, 1986). It is an excellent source of beta carotene which may prevent cancer, diabetes, and heart disease (Aravind *et al.*, 2013). The cultivation of papaya has recorded a tremendous increase in the recent years. However, its production has not shown corresponding increase. It is affected by a number of diseases caused by various pathogens and viruses. In recent years, the most destructive disease of *C. papaya* worldwide is papaya ring spot caused by papaya ring spot virus (PRSV) Type P. (Litz, 1984); (Manshardt, 1992), a definitive potyvirus species in the Potyviridae (Shukla *et al.*, 1994). It is grouped into two types, Type P (PRSV – P) infects both papaya and cucurbits and Type W (PRSV-W) infects only cucurbits and not papaya (Gonsalves, 1998).

The virus reduces fruit yield and ultimately results in the death of the plant (Manshardt, 1992). If papaya plants are infected with PRSV-P before they flower, they rarely produce fruit. Once infected, the plant's productive life is reduced from three years to one year or less. Incidence of PRSV has been reported to be more than 90 per cent in India (Hussain and Varma, 1994; Chandra and Samuel, 1999).

Resistance against PRSV was identified in *Vasconcellea cauliflora* (Jimenez and Horovitz, 1958; Moore and Litz, 1984), *V. cundinamarcensis* (syn; *pubescens*), *V. stipulata*, *V. candicans*, *V. quercifolia* and *V. heiborniinmpentagona* (Conover, 1964; Mekako and Nakasone, 1975).

Work on intergeneric hybridization in papaya is being attempted in many countries by conventional means as well as by embryo rescue method and by *in vitro* methods. However, not much progress has been made in this direction. Hence, an attempt was made at the Institute to introgress gene from *V. cauliflora* to Arka Surya intergeneric hybridization was initiated involving Arka Surya with *Vasconcellea cauliflora* to incorporate PRSV resistance and to evaluate the F_6 population of these progenies along with the parents.

Materials and Methods

Plant material

Intergeneric hybridization was carried out using *Carica papaya* var., Arka Surya as a female parent and *Vasconcellea cauliflora* as a male parent to incorporate the PRSV resistance gene. An advanced generation (F_6) progenies numbering 38 along with its parents were used for the studies at Indian Institute of Horticulture Sciences, Bengaluru, Karnataka during 2014-2015.

Evaluation of F_6 population

Sowing and transplanting

Single seeds of F_5 population were sown in polythene bags filled with soil, sand and FYM in 1:1:1 proportion. Germination was noticed in about 14 days after sowing. Regular watering and plant protection measures were carried out for the seedlings. Forty five days old healthy seedlings were transplanted in the main field at a spacing of 2.1 × 2.1 m and standard package of practices were followed during the period of study.

Sib mating

The intergeneric progenies were submitted to advance for next generation. The hermaphrodite flowers which are about to open the next day were bagged on the previous day evening. The pollen from the hermaphrodite plants were used to pollinate the female flowers.

Traits evaluated

Plant height was measured from ground level to the apical meristem at first flowering and at first harvest using measuring tape and expressed in centimetre (cm). The stem circumference was recorded at 10cm above the ground level using measuring tape both at first flowering and at first harvest and expressed in centimetre (cm).

Plant canopy spread (N-S, E-W) was recorded by measuring the distance from one end of leaf tip to other end of leaf tip in both North South and East-West direction during flowering and fruiting using measuring tape and expressed in centimetre (cm).

Fruit parameters *viz.*, fruit weight (g), fruit volume (ml), fruit length (cm), fruit width (cm), pulp thickness and cavity index (ml)

were derived from mean of 15 fruits harvested during the cropping season. The pulp colour was determined using Royal Horticulture Society chart and the total soluble solids of the fruit were determined using 'ERMA' hand refractometer and expressed in ^{o} Brix.

Total carotenoids and lycopene were estimated by spectrophotometric method suggested by Lichtenthaler (1987) and expressed in mg $100g^{-1}$FW.

Titrable acidity was determined by titration method (AOAC, 2000) and expressed as percentage of citric acid equivalents. Vitamin C content was determined by 2, 6-Dichlorophenol indophenol (DCPIP) method (AOAC, 2006) and expressed as mg of ascorbic acid per 100g fresh weight (mg $100g^{-1}$ FW).

PRSV screening

Screening of progenies under field conditions for PRSV was done during the cropping period and the disease intensity scoring was given based on symptoms on leaves and stem using the scale consists of five levels as 1-Resistant, 2-Tolerant, 3-Moderately tolerant, 4-Susceptible and 5-Highly susceptible based on the symptoms exhibited by the plant.

Results and Discussion

Morphological markers exhibited by F_6 population

Out of the 38 intergeneric progenies and two parents (Arka Surya, *Vasconcellea cauliflora*) evaluated, both broad leaves and narrow leaves were recorded among the progenies.

Broad leaf was observed in 35 progenies including male parent *V. cauliflora* and narrow leaf type was observed in 5 progenies including the female parent Arka Surya.

Qualitative markers for leaf pubescens, petiole colour and vein colour varied in the F_6 progenies (Table 1).

Fruit traits and yield parameters

The observations recorded on the fruit parameters varied considerably with respect to fruit traits like fruit weight (g), fruit length (cm), fruit width (cm), pulp thickness (cm), fruit volume (ml), fruit cavity index and yield (Table 2).

The fruit weight among the intergeneric progenies and parents recorded was highest in R_7P_{16} (820.00 g). Also, 26 progenies were found to be exceeding the mean fruit weight.

The fruit length was highest in $R_{17}P_{16}$ (17.56 cm) and the fruit width among the progenies recorded was highest in $R_{14}P_{14}$ (12.58 cm). The data recorded on fruit volume was in the range of 25.60 ml (*V. cauliflora)* to (758.00 ml) $R_{17}P_{16}$.

The cavity index was in the range of 9.25 ($R_{17}P_4$) to 27.62 *(V. cauliflora*) among the progenies and parents evaluated. The progenies $R_{14}P_7$, R_7P_{16}, R_5P_{16}, $R_{35}P_{10}$ and $R_{19}P_1$ also recorded a cavity index lower than the mean value (15.68).

The pulp thickness recorded was highest in the progeny R_3P_{15} (3.34 cm). Among the progenies evaluated, 27 progenies exceeded the mean pulp thickness of (2.83). The pulp colour recorded among the progenies and parents varied from yellow to orange red.

The number of fruits harvested was more in the hybrid progenies *viz.*, R_5P_{16} (74.00), R_6P_{16} (78.00), R_7P_{16} (81.00), $R_{14}P_7$ (79.00), $R_{17}P_{16}$ (74.00), $R_{19}P_1$ (67.00) and $R_{35}P_{10}$ (82.00). The maximum yield of progenies was recorded by R_7P_{16} (66.00 kg/tree) with 20 progenies

exceeding more than the mean yield (47.53) (Table 2).

Fruit quality parameters

Observations recorded on the fruit quality traits revealed that the total soluble solids (^{o}Brix), vitamin C (mg 100g^{-1} FW), titrable acidity (%), total carotenoids (mg 100g^{-1} FW) and lycopene (mg 100g^{-1} FW) varied considerably among the progenies (Table 3). The TSS ranged from 8.89 -10.44 ^{o}B, vitamin c ranging from 54.48 - 90.53mg 100g^{-1} FW among the 38 progenies evaluated. Lower acidity was recorded in hybrid progenies. The total carotenoids had a wide differences among the progenies evaluated. It ranged from 1.35 mg 100 g^{-1} FW (*V. cauliflora*) to 13.69 mg 100 g^{-1} FW ($R_{17}P_4$). Higher value of carotenoids was recorded in the hybrid progenies than *V. cauliflora*. Similar difference was recorded for lycopene among the progenies evaluated. The progeny $R_{11}P_{13}$ recorded the highest value with 5.44 mg 100g^{-1} FW.

PRSV score under field condition

PRSV scoring was carried out during vegetative, flowering, fruiting and at harvesting stages among the progenies, which indicated varying level of disease incidence.

Based on the final scoring at the time of harvest and after 16 months from planting the male parent *V. cauliflora* did not express any disease incidence and was found to be completely resistant (1), while the female parent Arka Surya expressed disease incidence at fruiting and was found to be susceptible (4). Among the progenies evaluated, field tolerance was observed in the progenies R_5P_{16}, R_6P_{16}, R_7P_{16}, $R_{14}P_7$, $R_{17}P_{16}$, $R_{19}P_1$ and $R_{35}P_{10}$ (Table 3) which registered disease incidence on leaves at the end of the crop period and very mild symptoms on fruits. In the remaining progenies, 20 were found to be moderately tolerant, 9 were susceptible and 3 were highly susceptible.

Table.1 Morphological markers exhibited by the F6 progenies

Morphological Characters	Female parent Arka Surya	Male parent *Vasconcellea cauliflora*	Hybrids (38 hybrids)
Leaf type	Narrow leaf	Broad leaf	34 hybrids with broad leaves and 4 hybrids with narrow leaves
Petiole colour	Green with light purple shades	Green with red purple	Variation in the extend of colour was recorded
Colour of leaf veins	Green	Green with purple shades	Variations in the extend of colour of leaf was observed

Table.2 Fruit and yield parameters of intergeneric progenies of papaya

Sl no	Progenies	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	Fruit volume (ml)	Cavity index (%)	Pulp thickness (cm)	Number of fruits/ tree	Yield (Kg/tree)	Pulp colour
1	R_2P_9	670.00	13.94	9.92	607.20	12.75	2.80	52.00	37.00	Orange red group (30) C
2	R_3P_{15}	790.00	16.76	10.70	681.00	15.21	3.34	58.00	51.00	Orange group (28) B
3	R_5P_{16}	810.00	14.42	12.44	727.00	15.50	3.12	74.00	62.00	Orange group (25)B
4	R_6P_{16}	780.00	16.29	11.32	678.00	16.06	2.94	78.00	64.00	Orange group (28)A
5	R_7P_{16}	820.00	14.28	11.30	747.00	15.35	2.96	81.00	66.00	Orange group (28)B
6	R_8P_7	680.00	13.50	10.32	576.00	11.08	2.82	67.00	48.00	Orange group 25(A)
7	$R_{10}P_9$	780.00	15.54	10.42	573.00	14.49	2.98	58.00	47.00	Orange group (28)A
8	$R_{10}P_{13}$	810.00	13.48	11.24	745.00	10.60	2.98	59.00	50.00	Orange group (25)A
9	$R_{11}P_8$	675.00	15.08	10.00	594.00	12.46	2.86	67.00	47.00	Orange group (25)A
10	$R_{11}P_{13}$	690.00	14.92	9.84	610.00	14.28	2.90	58.00	42.00	Orange group (25)A
11	$R_{12}P_6$	710.00	13.12	10.30	615.00	13.66	2.90	57.00	42.00	Orange group (28) B
12	$R_{12}P_{13}$	716.00	13.52	10.70	584.00	14.04	2.90	60.00	42.00	Orange group (28) B
13	$R_{14}P_6$	788.00	14.50	10.98	687.00	13.97	2.96	64.00	52.00	Orange group (28) B
14	$R_{14}P_7$	624.20	13.90	8.44	541.00	15.65	2.44	79.00	51.00	Orange group (28) A
15	$R_{14}P_{14}$	788.00	14.78	12.58	797.00	16.94	2.98	59.00	48.00	Orange group (28)A
16	$R_{17}P_4$	730.00	15.12	11.34	670.00	9.25	3.14	54.00	41.00	Orange group (25)A
17	$R_{17}P_{16}$	812.00	17.56	11.46	758.00	17.83	2.54	74.00	64.00	Orange group (25)A
18	$R_{18}P_{11}$	698.00	13.72	10.78	662.00	18.28	2.88	61.00	45.00	Orange Red group(30)C
19	$R_{19}P_1$	805.00	15.44	10.34	710.00	13.44	3.18	67.00	60.00	Orange Red group(30)C
20	$R_{19}P_4$	780.00	14.36	10.92	701.00	19.69	2.66	59.00	48.00	Orange group(28) A
21	$R_{19}P_6$	620.00	13.68	11.14	540.00	16.88	2.86	62.00	40.00	Orange group(28) B
22	$R_{19}P_{11}$	570.00	12.84	9.58	474.00	14.14	2.68	74.00	43.00	Orange group(25) A
23	$R_{20}P_2$	725.00	13.90	10.56	645.00	14.26	2.98	61.00	46.00	Orange group(25) B
24	$R_{20}P_7$	760.00	14.74	11.00	676.00	13.31	2.90	57.00	45.00	Orange group(25) B
25	$R_{21}P_2$	720.00	14.56	10.30	654.00	14.37	3.06	65.00	49.00	Orange group(28) B
26	$R_{21}P_4$	730.00	14.14	10.64	696.00	17.82	2.80	62.00	48.00	Orange group(28) A
27	$R_{21}P_7$	812.00	15.66	11.42	759.00	17.65	2.82	66.00	57.00	Orange group(28) B
28	$R_{21}P_9$	740.00	14.14	11.92	670.00	17.49	2.94	58.00	45.00	Orange Red group(30)C
29	$R_{21}P_{15}$	630.00	13.38	10.20	555.00	13.17	2.62	66.00	44.00	Orange group(28) B
30	$R_{25}P_5$	741.00	14.48	10.84	662.00	12.84	2.82	51.00	39.00	Orange Red group(30)C
31	$R_{26}P_7$	814.00	15.34	11.64	710.00	21.09	3.10	64.00	55.00	Orange group(25) A
32	$R_{26}P_{11}$	789.00	14.40	11.50	688.00	16.41	3.12	63.00	54.00	Orange Red group(30)C
33	$R_{27}P_{16}$	655.00	14.24	9.86	571.00	15.09	2.92	72.00	51.00	Orange Red group(30)C
34	$R_{29}P_5$	570.00	13.66	9.80	472.00	18.64	2.76	61.00	36.00	Orange group (24)A
35	$R_{35}P_{10}$	690.00	11.74	9.54	575.00	14.90	2.50	77.00	54.00	Orange group (25)A
36	$R_{36}P_{10}$	730.00	14.46	10.74	596.00	17.62	3.16	67.00	51.00	Orange group (24)A
37	$R_{44}P_3$	710.00	12.84	11.06	624.00	18.75	2.96	49.00	37.00	Orange group (28)B
38	$R_{55}P_5$	745.00	14.20	11.34	662.00	16.77	2.90	53.00	42.00	Orange group (28)B
39	Arka Surya	580.00	12.64	9.64	450.00	14.60	2.36	79.00	45.00	Orange group 28(B)
40	*V. cauliflora*	62.20	8.84	3.66	25.60	27.62	0.46	211.00	13.00	Yellow group 4 (D)
	Mean	708.86	14.20	10.54	621.62	15.72	2.83	67.70	47.53	
	SEm±	20.04	0.22	0.22	20.03	0.52	0.07	3.90	1.49	

Table.3 Fruit quality traits and PRSV score of intergeneric progenies of papaya

Sl.no.	Progenies	TSS (^{o}Brix)	Vitamin C (mg 100g^{-1}FW)	Titrable acidity (%)	Total Carotenoids (mg 100g^{-1}FW)	Lycopene (mg 100g^{-1} FW)	PRSV scoring
1	R_2P_9	9.80	67.57	0.120	5.23	1.33	5
2	R_3P_{15}	8.92	76.66	0.110	4.99	1.67	3
3	R_5P_{16}	9.20	76.09	0.110	7.81	2.76	2
4	R_6P_{16}	9.88	70.34	0.120	7.14	1.68	2
5	R_7P_{16}	9.20	68.15	0.130	7.99	2.75	2
6	R_8P_7	9.16	81.84	0.130	8.44	1.93	4
7	$R_{10}P_9$	9.20	82.68	0.130	7.49	1.83	4
8	$R_{10}P_{13}$	9.62	77.27	0.110	13.30	5.00	3
9	$R_{11}P_8$	9.20	54.48	0.090	2.12	1.24	5
10	$R_{11}P_{13}$	10.24	73.86	0.150	12.93	5.44	3
11	$R_{12}P_6$	9.36	76.78	0.120	6.87	2.04	5
12	$R_{12}P_{13}$	8.84	75.56	0.130	2.37	1.13	4
13	$R_{14}P_6$	9.12	70.03	0.130	8.82	3.21	3
14	$R_{14}P_7$	9.08	79.59	0.120	5.53	1.45	2
15	$R_{14}P_{14}$	9.48	77.34	0.140	4.24	1.25	3
16	$R_{17}P_4$	10.44	79.08	0.100	13.69	4.26	4
17	$R_{17}P_{16}$	10.04	90.53	0.150	9.08	2.69	2
18	$R_{18}P_{11}$	9.00	66.04	0.120	7.76	2.80	3
19	$R_{19}P_1$	9.46	81.97	0.140	3.63	1.30	2
20	$R_{19}P_4$	9.32	67.46	0.130	3.63	2.19	3
21	$R_{19}P_6$	10.12	70.11	0.120	11.33	4.69	4
22	$R_{19}P_{11}$	9.03	67.41	0.080	10.25	4.69	3
23	$R_{20}P_2$	10.08	71.83	0.080	7.96	2.69	3
24	$R_{20}P_7$	10.00	59.90	0.080	5.50	1.82	3
25	$R_{21}P_2$	9.08	78.60	0.090	6.61	2.43	3
26	$R_{21}P_4$	9.52	90.47	0.120	8.60	2.83	3
27	$R_{21}P_7$	10.2	61.21	0.130	4.39	1.00	3
28	$R_{21}P_9$	9.40	60.15	0.130	10.65	4.22	4
29	$R_{21}P_{15}$	9.56	88.55	0.150	3.99	2.61	4
30	$R_{25}P_5$	9.52	87.24	0.120	6.39	2.73	3
31	$R_{26}P_7$	9.32	60.88	0.120	2.70	0.40	3
32	$R_{26}P_{11}$	9.16	79.35	0.150	11.49	5.14	3
33	$R_{27}P_{16}$	9.52	81.97	0.160	6.42	2.44	3
34	$R_{29}P_5$	9.44	65.71	0.120	6.05	1.85	3
35	$R_{35}P_{10}$	9.05	65.72	0.110	6.79	2.04	2
36	$R_{36}P_{10}$	10.00	74.64	0.140	6.68	2.67	3
37	$R_{44}P_3$	9.84	75.10	0.120	6.46	1.53	3
38	$R_{55}P_5$	9.36	62.26	0.130	4.26	0.92	4
39	Arka Surya	11.68	92.85	0.130	7.07	3.32	4
40	*V.Cauliflora*	7.72	36.39	0.220	1.35	0.43	1
	Mean	9.55	72.88	0.130	6.85	2.40	-
	SEm±	0.09	1.74	0.004	0.48	0.209	-

PRSV Score: 1-Resistant, 2- Tolerant, 3- Moderately tolerant, 4-Susceptible & 5-Highly susceptible

Fig.1 Variability in fruit shapes, size and pulp colour of intergeneric progenies

Fig.2 Field view of selected progenies with field tolerance

Morphological parameters

Morphological markers play an important role in identification of the hybrid progenies, which are reliable and are easily distinguishable by visual observation. The progenies segregated for both broad and narrow leaves. The male parent *V. cauliflora* bears broad leaves with red purple petiole which acts as a morphological marker for identification of progenies with broad leaf. The progenies were also recorded with green and red purple shade petiole in R_5P_{16}, R_6 P_{16}, R_7P_{16}, R_{17} P_{16} and $R_{35}P_{10}$ similar to that of the male parent. Similarly, green with purple vein was noticed in the progenies R_5P_{16}, R_6P_{16}, R_7P_{16}, $R_{14}P_7$, $R_{17}P_{16}$ and $R_{35}P_{10}$ as in case of *V. cauliflora.* Intermediate morphological characters have been used previously for the identification of *C. papaya* x *C. cauliflora* interspecific hybrids by Khuspe *et al.,* (1980) and Chen *et al.,* (1991). Jayavalli (2010) had also registered intermediate morphological characters in F_1 progenies of the crosses used in the study. Dinesh *et al.,* (2013) had also observed segregation of leaf in papaya (Table 3).

Fruit traits and yield parameters

Fruits are the economical part which contributes to the final yield. These traits are highly heritable and the fruit size is determined by the fruit weight which also contributes to the final yield. The fruit weight, fruit length, fruit width, per cent cavity index, pulp colour of the intergeneric progenies varied among the progenies (Fig. 1). The reason attributed for the wide variation observed might be due to the inherent genetic makeup of the progenies (Fig 1).

Similar results were also reported by earlier workers (Praveen, 2005; Muthulakshmi *et al.,* 2007; Jayavalli, 2010; Sudha *et al.,* 2103) in intergeneric hybrids evaluated for PRSV disease.

Yield depends on the morphological, physiological and parameters *viz.,* fruit weight and number of fruits. The number of fruits harvested was more in the hybrid progenies *viz.,* R_5P_{16}, R_6P_{16}, R_7P_{16}, $R_{14}P_7$, $R_{17}P_{16}$, $R_{19}P_1$and $R_{35}P_{10}$ hence maximum yield was recorded in these respective progenies. Sudha *et al.,* (2013), Jayavalli (2010), also reported a higher fruit number and yield in the cross Pusa Nanha x *V. cauliflora.*

Fruit quality parameters

Fruit quality is an important trait of interest in any research programme which needs much attention. As the wild species used in the study is of poor quality, there are ample of possibilities for getting poor quality fruits in the resultant hybrids. In the present study also, several progenies were marginally affected due to the nature of male parent (*V. cauliflora*) used in the intergeneric hybridization. Reduction in quality characters like total soluble solids, acidity, carotenoids, lycopene were observed in the progenies. However, some progenies were found to have desirable qualities near to that of the female parent Arka Surya. It was close to the earlier findings of Sudha *et al.,* (2013) and Jayavalli (2010) where there was also a reduction in the total soluble solids, acidity and sugar acid ratio in intergeneric progenies.

PRSV score under field condition

Among the progenies evaluated for PRSV, varying level of disease incidence was noticed. Field tolerance was observed in seven intergeneric progenies *viz.*, R_5P_{16}, R_6 P_{16}, R_7P_{16}, $R_{14}P_7$, R_{17} P_{16}, $R_{19}P_1$ and $R_{35}P_{10}$(Fig 2). They registered disease incidence on leaves at the end of the crop period and very mild symptoms on fruits but the plants were able to tolerate the disease incidence and put forth vigorous growth. This was in agreement with the earlier findings of Dhanam (2006) and Roff (2007) in papaya

who also recorded lowest disease intensity score in the field tolerant lines. They also recorded the delay in onset of symptoms which suggests the increased tolerance in the F_2 progenies and the genes conferring tolerance must have been inherited from *V. cauliflora.* This is in close confirmity with the results of Jayavalli (2010).

It can be concluded from the present investigation which indicates that *Vasconcellea cauliflora* can be employed to develop a variable population with field tolerance/resistance. The evalution resulted that seven progenies R_5P_{16}, R_6P_{16}, R_7P_{16}, $R_{14}P_7$, $R_{17}P_{16}$, $R_{19}P_1$ and $R_{35}P_{10}$ were found to be tolerant for PRSV under field conditions. Thus, based on the morphological traits, fruit quality and PRSV tolerance the advanced intergeneric progenies *viz.*, R_5P_{16}, R_6P_{16}, R_7P_{16}, $R_{14}P_7$, $R_{17}P_{16}$, $R_{19}P_1$ and $R_{35}P_{10}$ may be forwarded for next generation (F_7) and further evaluation.

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